Documents regarding Approval of

CNG Manual Valve of class 0

Of BMT Co. Ltd. Make

Approval number: **E4-110R-000307-00**

Report No: **IN110-A0-120034** Dated **16-July-2012**

Name of technical service

TÜV NORD Mobilität GmbH & Co. KG
Institut für Fahrzeugtechnik und Mobilität
Adlerstr. 7
D-45307 Essen

CONTENTS

RDW

Vehicle Technology Division

THE NETHERLANDS
(N E D E R L A N D)

E4

COMMUNICATION

Concerning [1]:

- approval granted
~~- approval extended~~
~~- approval refused~~
~~- approval withdrawn~~
~~- production definitely discontinued~~

of a type of CNG component pursuant to Regulation number 110.

Approval number: E4-110R-000307 **Extension number: 00**

1. CNG component considered:

- ~~Container(s) or cylinder(s)~~ [1]
- ~~Pressure indicator~~
- ~~Pressure relief valve~~
- ~~Automatic valve(s)~~
- ~~Excess flow valve~~
- ~~Gas-tight housing~~
- ~~Pressure regulator(s)~~
- ~~Non-return valve(s)~~
- ~~Pressure relief device~~
- Manual valve
- ~~Flexible fuel lines~~
- ~~Filling unit or receptacle~~
- ~~Gas injector(s)~~
- ~~Gas flow adjuster~~
- ~~Gas/air mixer~~
- ~~Electronic control unit~~
- ~~Pressure and temperature sensor(s)~~
- ~~CNG filter(s)~~

2. Trade name or mark : SUPERLOK T&S VALVES
High Pressure Ball Valve
(SCBV3601, SCBV3602, SCBV3603)

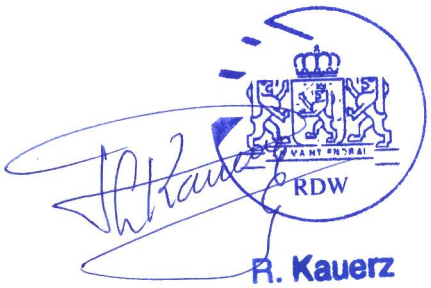
P.O. Box 777
2700 AT Zoetermeer
The Netherlands

Tel. + 31 (0)79 345 81 43
Fax + 31 (0)79 345 80 43
www.rdw.nl

Vehicle Approval and Information

Approval number: E4-110R-000307 **Extension number: 00**

	Manufacturer's name and address	: BMT CO., LTD 21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 S.Korea
4.	If applicable, name and address of manufacturer's representative	: NA
5.	Submitted for approval on	: December'2011
6.	Technical service responsible for conducting approval tests	: **TÜV NORD Mobilität GmbH & Co. KG** Institut für Fahrzeugtechnik und Mobilität Adlerstr. 7 D-45307 Essen
7.	Date of report issued by that service	: 16-July-2012
8.	Number of report issued by that service	: IN110-A0-120034
9.	Approval	: granted/~~refused/extended/withdrawn~~ (1)
10.	Reason(s) of extension (if applicable)	: NA
11.	Place	: ZOETERMEER
12.	Date	: 06-NOV-2012
13.	Signature	:



14. The documents filed with the application or extension of approval can be obtained upon request.

(1) Strike out what does not apply.

Approval number: E4-110R-000307 **Extension number: 00**

ADDENDUM

1. Additional information concerning the type-approval of a type of CNG components pursuant to Regulation number 110.

1.1.	Container(s) or cylinder(s)	
1.1.1.	Dimensions	: Not Applicable
1.1.2.	Material	: Not Applicable
1.2.	Pressure indicator	
1.2.1.	Working pressure(s) (2)	: Not Applicable
1.2.2.	Material	: Not Applicable
1.3.	Pressure relief valve (discharge valve)	
1.3.1.	Working pressure(s) (2)	: Not Applicable
1.3.2.	Material	: Not Applicable
1.4.	Automatic valve(s)	
1.4.1.	Working pressure(s) (2)	: Not Applicable
1.4.2.	Material	: Not Applicable
1.5.	Excess flow valve	
1.5.1.	Working pressure(s) (2)	: Not Applicable
1.5.2.	Material	: Not Applicable
1.6.	Gas-tight housing	
1.6.1.	Working pressure(s) (2)	: Not Applicable
1.6.2.	Material	: Not Applicable
1.7.	Pressure regulator(s)	
1.7.1.	Working pressure(s) (2)	: Not Applicable
1.7.2.	Material	: Not Applicable
1.8.	Check valve(s) or non-return valve(s)	
1.8.1.	Working pressure(s) (2)	: Not Applicable
1.8.2.	Material	: Not Applicable
1.9.	Pressure relief device (temperature triggered)	
1.9.1.	Working pressure(s) (2)	: Not Applicable
1.9.2.	Material	: Not Applicable
1.10.	Manual valve	
1.10.1.	Working pressure(s) (2)	: 260 bar for consideration of R110
1.10.2.	Material	: 316 Stainless steel
1.11.	Flexible fuel lines	
1.11.1.	Working pressure(s) (2)	: Not Applicable
1.11.2.	Material	: Not Applicable
1.12.	Filling unit or receptacle	
1.12.1.	Working pressure(s) (2)	: Not Applicable
1.12.2.	Material	: Not Applicable

Approval number: E4-110R-000307 **Extension number: 00**

1.13.	Gas injector(s)	
1.13.1.	Working pressure(s) [(2)]	: Not Applicable
1.13.2.	Material	: Not Applicable
1.14.	Gas flow adjuster	
1.14.1.	Working pressure(s) [(2)]	: Not Applicable
1.14.2.	Material	: Not Applicable
1.15.	Gas/air mixer	
1.15.1.	Working pressure(s) [(2)]	: Not Applicable
1.15.2.	Material	: Not Applicable
1.16.	Electronic control unit (CNG-fuelling)	
1.16.1.	Basic software principles	: Not Applicable
1.17.	Pressure and temperature sensor(s)	
1.17.1.	Working pressure(s) [(2)]	: Not Applicable
1.17.2.	Material	: Not Applicable
1.18.	CNG filter(s)	
1.18.1.	Working pressure(s) [(2)]	: Not Applicable
1.18.2.	Material	: Not Applicable

[(2)] Specify the tolerance

BMT CO., LTD
21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 S.Korea
Tel: 82-55-783-1000 Fax: 82-55-783-1110
http://www.superlok.com

This is for Type Approval of ECE Regulation 110 (CNG) for Specific Components of Vehicles

INFORMATION DOCUMENT No : BMT-CNG-120717-01

Essential Characteristics of the CNG Component

1.1 Trade Name or Mark : SUPERLOK T&S VALVES

1.2 Maker name and Address: BMT CO., LTD
21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 South Korea

1.3 Type/General commercial description:
SCBV360 SERIES/HIGH PRESSURE BALL VALVE

1.4 Working Pressure(s) :

Valve Name	Working Pressure for ECE R110 TYPE
High-pressure Ball Valve	260 bar

1.5 Description and Drawings : See attached document

1.6 Material : 316 Stainless steel

1.7 Operating temperatures :

Valve Name	Temperature rating
High-pressure Ball Valve	-40℃ to 120℃

1.8 Remarks: Manual valve

JE MAINTIENDRAI
RDW

BMT CO., LTD
21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 S.Korea
Tel: 82-55-783-1000 Fax: 82-55-783-1110
http://www.superlok.com

2. Features of High Pressure Ball Valves

SCBV360 High-pressure Ball Valve

- Compact design
- High flow rate with maximum orifice
- Variety of End Connections
- Anti blow-out stem design

3. Description

	High Pressure Ball valve
Working Pressure for ECE R110 TYPE	260 bar
Temperature rating	-40℃ to 120℃
Body material	316 Stainless Steel
Port Connection	1/4″ to 1″ and 6mm to 25mm
Orifice	10.0mm to 19.0mm

4. Working Pressure and MAWP

Valve Name	Working Pressure for ECE R110 TYPE
High Pressure Ball valve	260 bar

5. Material Standard

Material Grade	Bar Stock	Forgings
316 Stainless Steel	ASTM A276, A479 ASME SA479	ASTM A182 ASME SA182

BMT CO., LTD
21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 S.Korea
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http://www.superlok.com

6. Non-Metallic Materials

6.1 O-ring

Elastomer base	EPDM
Hardness Shore A Durometer	70 +/-5
Tensile Strength	7.5 MPa

6.2 Seat & Packing

Chemical Designation	Tensile Strength
Polyterafluoroethylene (PTFE)	20MPa
Poly ether ether ketone (PEEK)	80MPa

JE MAINTIENDRAI
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Tel: 82-55-783-1000 Fax: 82-55-783-1110
http://www.superlok.com

7. Manufacturer's Statement

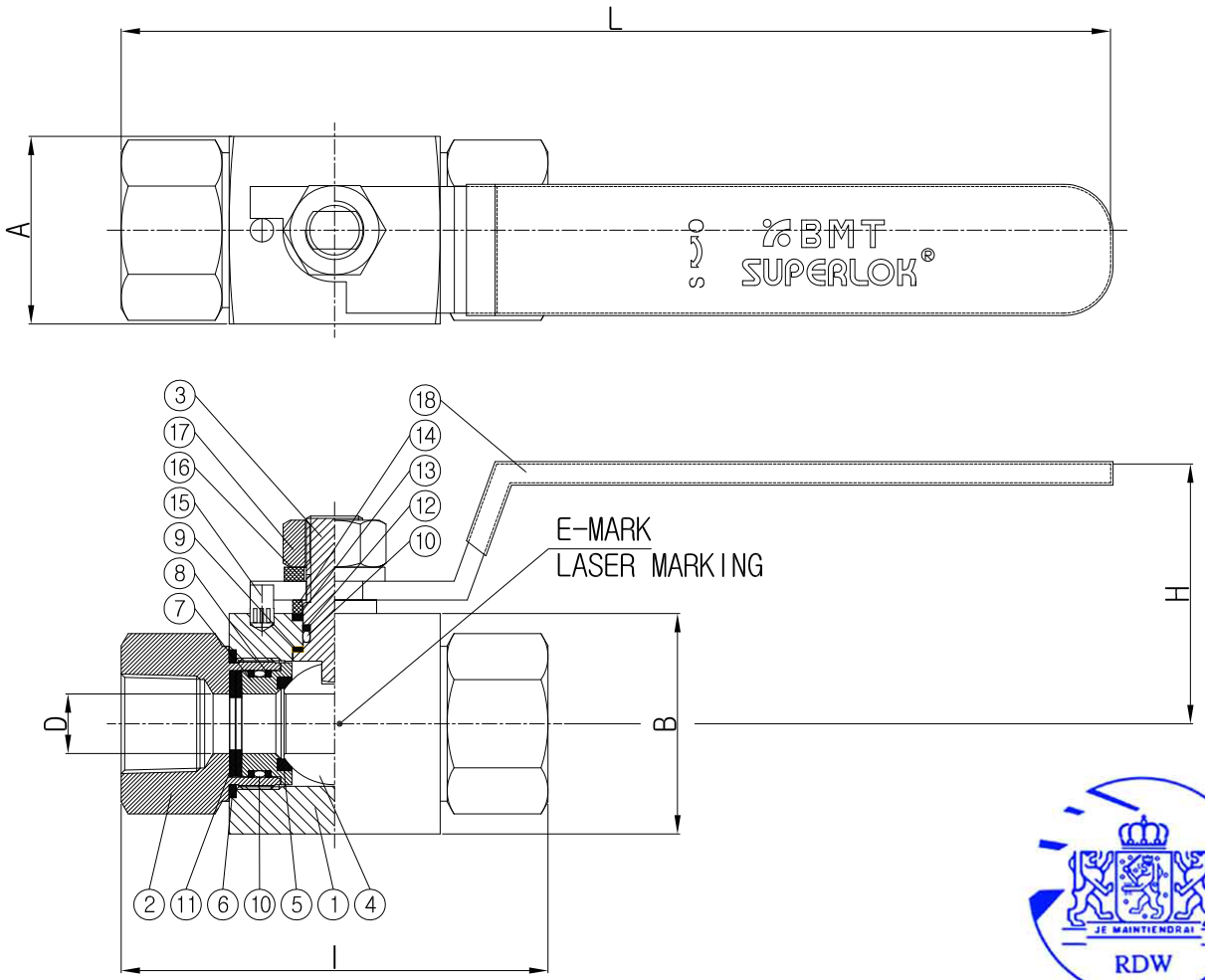
The samples, which have been presented for evaluation, are made during mass production according to the presented documents.
We, as the producer of SUPERLOK T&S VALVE, carry on our own responsibility - the production process guarantees the parameter stability & unchanging and outlet inspection guarantee. SUPELOK T&S VALVE will accomplish permanently the requirements which are specified by our instruction.

8. Pictures of High Pressure Ball Valves

Picture 1. SCBV360 High Pressure Ball Valve

9. Drawings

NO	TITLE	DWG No.
1	SCBV360 High Pressure Ball Valve	111124-01-114-01 (Rev.A)
2	Type Approval Mark	111124-01-114-07 (Rev.A)



NO	DESCRIPTION	MATERIAL	Q'TY	REMARK
1	BODY	SS 316	1	
2	EMD CONNECTION	SS 316	2	
3	STEM	SS 316	1	
4	BALL	SS 316	1	
5	SEAT	PEEK	2	
6	CONNECTOR SEAL	PTFE	2	
7	SEAT RETAINER	SS 316	2	
8	BACKUP-RING	PTFE	4	
9	THRUST WASHER	PEEK	1	
10	O-RING	EPDM	3	
11	DISC SPRING	SS 304	4	
12	STEM BACKUP-RING	PTFE	1	
13	PACKING	PTFE	1	
14	PACKING GLAND	SS 316	1	
15	STOP PIN	SS 316	1	
16	PLAN WASHER	SS 304	1	
17	NUT	SS 304	1	
18	HANDLE	SS 304	1	

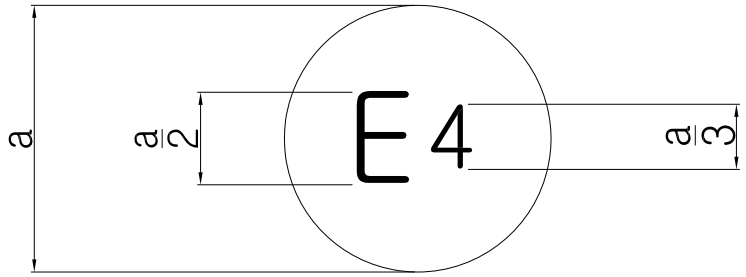
Unit : mm

PART NO.	END CONNECTION	A	B	L	I	H	D	Q'TY	WORKING PRESSURE for ECE R110 TYPE	MAX WORKING PRESSURE
SCBV3601-S4	1/4" SUPERLOK	32	38	161.3	91.6	44.5	4.8	2 EA	260 bar	414 bar
SCBV3601-M8N	1/2" MALE NPT	32	38	162.5	94	44.5	10	2 EA	260 bar	414 bar
SCBV3601-F6N	3/8" FEMALE NPT	32	38	153.5	76	44.5	10	2 EA	260 bar	414 bar
SCBV3602-S10	5/8" SUPERLOK	40	47	220.3	109.6	55.4	12.7	2 EA	260 bar	414 bar
SCBV3602-M12N	3/4" MALE NPT	40	47	218	105	55.4	12.7	2 EA	260 bar	414 bar
SCBV3602-F8N	1/2" FEMALE NPT	40	47	208	85	55.4	12.7	2 EA	260 bar	414 bar
SCBV3603-S16	1" SUPERLOK	50	54	230.4	130	59	19	2 EA	260 bar	414 bar
SCBV3603-M16N	1" MALE NPT	50	54	229.3	127.6	59	19	2 EA	260 bar	414 bar
SCBV3603-F12N	3/4" FEMALE NPT	50	54	220	108	59	19	2 EA	260 bar	414 bar

Rev.	Issue Data	Description	Originator	Checked	Approved
A	24.NOV.11	Issued for Approval	C.S.RA	S.M.LEE	J.H.LIM

PURCHASER	
CLIENT	
PROJECT NAME PROJECT NO. PO. NO.	- - -
MFR. MODEL/TYPE VALVE NAME	SCBV360 SERIES HIGH PRESSURE BALL VALVE
TAG NO.	-
DRAWING NO.	111124-01-114-01
GENERAL ARRANGEMENT DRAWING for VALVE	BMT Co., Ltd.

NO.	DESCRIPTION	MATERIAL	Q'TY	REMARK



Approval mark Drawing

110 R-XXXXXX

a ≥ 8mm

Rev.	Issue Data	Description	Originator	Checked	Approved
A	24.NOV.11	Issued for Approval	C.S.RA	S.M.LEE	J.H.LIM

PURCHASER	
CLIENT	
PROJECT NAME	-
PROJECT NO.	-
PO. NO.	-
MFR. MODEL/TYPE	-
VALVE NAME	-
TAG NO.	-
DRAWING NO.	111124-01-114-07

GENERAL ARRANGEMENT DRAWING for VALVE

BMT Co., Ltd.

Test Report
No.: IN110-A0-120034
Dated: 16/07/2012
ECE Regulation No.110

Type : High-pressure ball Valve (SCBV360 Series)

Manufacturer : BMT CO., LTD

Test Report

AGREEMENT CONCERNING THE ADOPTION OF UNIFORM TECHNICAL PRESCRIPTIONS FOR WHEELED VEHICLES, EQUIPMENT AND PARTS WHICH CAN BE FITTED AND/OR BE USED ON WHEELED VEHICLES AND THE CONDITIONS FOR RECIPROCAL RECOGNITIONOF APPROVALS GRANTED ON THE BASIS OF THESE PRESCRIPTIONS

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF:
SPECIFIC COMPONENTS OF MOTOR VEHICLES USING COMPRESSED NATURAL GAS (CNG) IN THEIR PROPULSION SYSTEM

ECE-R 110
as last amended

Revision 1 – Amendment 1 - Amendment 2
Including Supplement 9 to Regulation No. 110 – Date of entry into force: 19 August 2010

Approval status	
	Number of approval
ECE	Previous Approval: Nil
	Current Approval No. E4-110R-000307

Test Report
No.: IN110-A0-120034
Dated: 16/07/2012
ECE Regulation No.110

Type : High-pressure ball Valve (SCBV360 Series)

Manufacturer : BMT CO., LTD

0.0	General		
0.1	Make	:	SUPERLOK T&S VALVES
0.2	Manufacturer's name and address	:	BMT CO., LTD 21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 S.Korea
0.3	Type and commercial Description	:	High Pressure Ball Valve (SCBV360 Series). (SCBV 3601, SCBV3602, SCBV 3603)
0.4	Working Pressure	:	260 bar Class 0
1.0	Test information		
1.1	Test Objects	:	Manual Valve
1.2	Test dates	:	May'2012 to June'2012
1.3	Equipment /facilities used	:	The test equipment and facilities used were in compliance with the requirements of the Standards

2.0 **Equipment used**

	Equipment	**Make/Model**	**Calibration Validity**
2.1	Salt Chamber	CM Enviro	Jan'13
2.2	Over Pressure Test	Praj	Dec'12
2.3	Hot Chamber	S A Electrical	Feb'13
2.4	Cold Chamber	Praj	Dec'12
2.5	Ammonia Chamber	Praj	Dec'12
2.6	Temperature cyclic test setup	ARAI	Dec'12

Test Report
No.: IN110-A0-120034
Dated: 16/07/2012
ECE Regulation No.110

Type : High-pressure ball Valve (SCBV360 Series)

Manufacturer : BMT CO., LTD

High Pressure Ball Valve 360 Series

PART NO.	END CONNECTION	A	B	L	I	H	D	Q'TY	WORKING PRESSURE for ECE R110 TYPE	MAX WORKING PRESSURE
SCBV3601-S4	1/4" SUPERLOK	32	38	161.3	91.6	44.5	4.8	2 EA	260 bar	414 bar
SCBV3601-M8N	1/2" MALE NPT	32	38	162.5	94	44.5	10	2 EA	260 bar	414 bar
SCBV3601-F6N	3/8" FEMALE NPT	32	38	153.5	76	44.5	10	2 EA	260 bar	414 bar
SCBV3602-S10	5/8" SUPERLOK	40	47	220.3	109.6	55.4	12.7	2 EA	260 bar	414 bar
SCBV3602-M12N	3/4" MALE NPT	40	47	218	105	55.4	12.7	2 EA	260 bar	414 bar
SCBV3602-F8N	1/2" FEMALE NPT	40	47	208	85	55.4	12.7	2 EA	260 bar	414 bar
SCBV3603-S16	1" SUPERLOK	50	54	230.4	130	59	19	2 EA	260 bar	414 bar
SCBV3603-M16N	1" MALE NPT	50	54	229.3	127.6	59	19	2 EA	260 bar	414 bar
SCBV3603-F12N	3/4" FEMALE NPT	50	54	220	108	59	19	2 EA	260 bar	414 bar

Conclusion of matrix: BMT produces Manual valves as provided in the matrix. Based on the above information and analyzing, a WCC is obtained and valve SCBV3601-F6N (Low fitting and orifice size) and SCBV3603-S16 (High fitting and orifice size) are taken for testing, hence all other valves which fall within the matrix need not be tested.

List of Enclosures:

Enclosure 1: Information Documents and Drawings
Enclosure 2: Results of Test

Test Report
No.: IN110-A0-120034
Dated: 16/07/2012
ECE Regulation No.110

Type : High-pressure ball Valve (SCBV360 Series)

Manufacturer : BMT CO., LTD

3.0 Statement of Conformity

The type described in this test report and the appendices attached are in compliance with the Test Specification mentioned above.
The Test Report comprises pages 1 to 6.
The Test Report shall be reproduced and published in full only and by the client only. It shall be reproduced partially with the written permission of the Test Laboratory only.

TEST LABORATORY

TÜV NORD Mobilität GmbH & Co. KG
IFM - Institut für Fahrzeugtechnik und Mobilität,
Adlerstr. 7, 45307 Essen

Designated Technical Service
RDW No. 99050016

Pune, India. 16.07.2012

Yeshwant Ambure
Project Leader

M. S. Ogale
Head Homologation

Test Report
No.: IN110-A0-120034
Dated: 16/07/2012
ECE Regulation No.110

Type : High-pressure ball Valve (SCBV360 Series)

Manufacturer : BMT CO., LTD

List of modifications

Appendix 1

More details for application of : **Date** :

Correction of : -

Modification of : -

Addition of : -

Deletion of : -

BMT CO., LTD
21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 S.Korea
Tel: 82-55-783-1000 Fax: 82-55-783-1110
http://www.superlok.com

This is for Type Approval of ECE Regulation 110 (CNG) for Specific Components of Vehicles

INFORMATION DOCUMENT No : BMT-CNG-120717-01

Essential Characteristics of the CNG Component

1.1 Trade Name or Mark : SUPERLOK T&S VALVES

1.2 Maker name and Address: BMT CO., LTD
21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 South Korea

1.3 Type/General commercial description:
SCBV360 SERIES/HIGH PRESSURE BALL VALVE

1.4 Working Pressure(s) :

Valve Name	Working Pressure for ECE R110 TYPE
High-pressure Ball Valve	260 bar

1.5 Description and Drawings : See attached document

1.6 Material : 316 Stainless steel

1.7 Operating temperatures :

Valve Name	Temperature rating
High-pressure Ball Valve	-40℃ to 120℃

1.8 Remarks: Manual valve

BMT CO., LTD
21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 S.Korea
Tel: 82-55-783-1000 Fax: 82-55-783-1110
http://www.superlok.com

2. Features of High Pressure Ball Valves

SCBV360 High-pressure Ball Valve

- Compact design
- High flow rate with maximum orifice
- Variety of End Connections
- Anti blow-out stem design

3. Description

	High Pressure Ball valve
Working Pressure for ECE R110 TYPE	260 bar
Temperature rating	-40℃ to 120℃
Body material	316 Stainless Steel
Port Connection	1/4″ to 1″ and 6mm to 25mm
Orifice	10.0mm to 19.0mm

4. Working Pressure and MAWP

Valve Name	Working Pressure for ECE R110 TYPE
High Pressure Ball valve	260 bar

5. Material Standard

Material Grade	Bar Stock	Forgings
316 Stainless Steel	ASTM A276, A479 ASME SA479	ASTM A182 ASME SA182

BMT CO., LTD
21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 S.Korea
Tel: 82-55-783-1000 Fax: 82-55-783-1110
http://www.superlok.com

6. Non-Metallic Materials

6.1 O-ring

Elastomer base	EPDM
Hardness Shore A Durometer	70 +/-5
Tensile Strength	7.5 MPa

6.2 Seat & Packing

Chemical Designation	Tensile Strength
Polyterafluoroethylene (PTFE)	20MPa
Poly ether ether ketone (PEEK)	80MPa

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7. Manufacturer's Statement

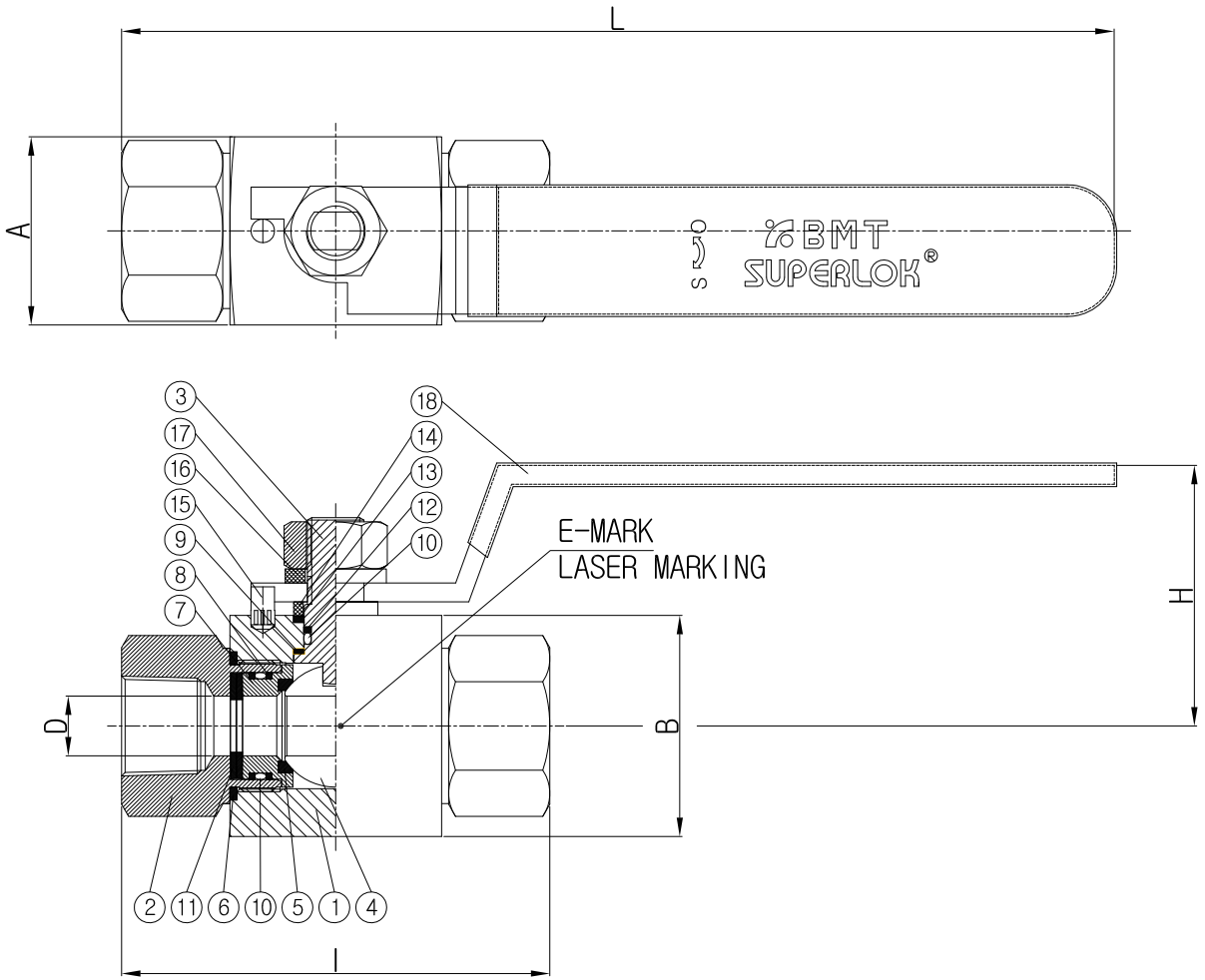
The samples, which have been presented for evaluation, are made during mass production according to the presented documents.
We, as the producer of SUPERLOK T&S VALVE, carry on our own responsibility - the production process guarantees the parameter stability & unchanging and outlet inspection guarantee. SUPELOK T&S VALVE will accomplish permanently the requirements which are specified by our instruction.

8. Pictures of High Pressure Ball Valves

Picture 1. SCBV360 High Pressure Ball Valve

9. Drawings

NO	TITLE	DWG No.
1	SCBV360 High Pressure Ball Valve	111124-01-114-01 (Rev.A)
2	Type Approval Mark	111124-01-114-07 (Rev.A)



NO	DESCRIPTION	MATERIAL	Q'TY	REMARK
1	BODY	SS 316	1	
2	EMD CONNECTION	SS 316	2	
3	STEM	SS 316	1	
4	BALL	SS 316	1	
5	SEAT	PEEK	2	
6	CONNECTOR SEAL	PTFE	2	
7	SEAT RETAINER	SS 316	2	
8	BACKUP-RING	PTFE	4	
9	THRUST WASHER	PEEK	1	
10	O-RING	EPDM	3	
11	DISC SPRING	SS 304	4	
12	STEM BACKUP-RING	PTFE	1	
13	PACKING	PTFE	1	
14	PACKING GLAND	SS 316	1	
15	STOP PIN	SS 316	1	
16	PLAN WASHER	SS 304	1	
17	NUT	SS 304	1	
18	HANDLE	SS 304	1	

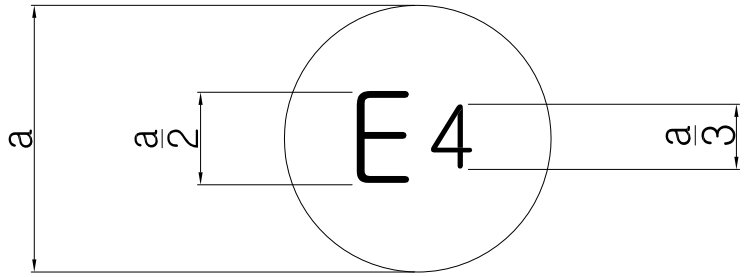
Unit : mm

PART NO.	END CONNECTION	A	B	L	I	H	D	Q'TY	WORKING PRESSURE for ECE R110 TYPE	MAX WORKING PRESSURE
SCBV3601-S4	1/4" SUPERLOK	32	38	161.3	91.6	44.5	4.8	2 EA	260 bar	414 bar
SCBV3601-M8N	1/2" MALE NPT	32	38	162.5	94	44.5	10	2 EA	260 bar	414 bar
SCBV3601-F6N	3/8" FEMALE NPT	32	38	153.5	76	44.5	10	2 EA	260 bar	414 bar
SCBV3602-S10	5/8" SUPERLOK	40	47	220.3	109.6	55.4	12.7	2 EA	260 bar	414 bar
SCBV3602-M12N	3/4" MALE NPT	40	47	218	105	55.4	12.7	2 EA	260 bar	414 bar
SCBV3602-F8N	1/2" FEMALE NPT	40	47	208	85	55.4	12.7	2 EA	260 bar	414 bar
SCBV3603-S16	1" SUPERLOK	50	54	230.4	130	59	19	2 EA	260 bar	414 bar
SCBV3603-M16N	1" MALE NPT	50	54	229.3	127.6	59	19	2 EA	260 bar	414 bar
SCBV3603-F12N	3/4" FEMALE NPT	50	54	220	108	59	19	2 EA	260 bar	414 bar

Rev.	Issue Data	Description	Originator	Checked	Approved
A	24.NOV.11	Issued for Approval	C.S.RA	S.M.LEE	J.H.LIM

PURCHASER	
CLIENT	
PROJECT NAME	-
PROJECT NO.	-
PO. NO.	-
MFR. MODEL/TYPE VALVE NAME	SCBV360 SERIES HIGH PRESSURE BALL VALVE
TAG NO.	-
DRAWING NO.	111124-01-114-01
GENERAL ARRANGEMENT DRAWING for VALVE	BMT Co., Ltd.

NO.	DESCRIPTION	MATERIAL	Q'TY	REMARK



Approval mark Drawing

110 R-XXXXXX

a ≥ 8mm

Rev.	Issue Data	Description	Originator	Checked	Approved
A	24.NOV.11	Issued for Approval	C.S.RA	S.M.LEE	J.H.LIM

PURCHASER	
CLIENT	
PROJECT NAME	-
PROJECT NO.	-
PO. NO.	-
MFR. MODEL/TYPE	-
VALVE NAME	-
TAG NO.	-
DRAWING NO.	111124-01-114-07
GENERAL ARRANGEMENT DRAWING for VALVE	BMT Co., Ltd.

Manufacturer: BMT CO., LTD

Component type: High Pressure Ball Valve SCBV360 Series.

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RECORD OF TEST ON
CNG Manual valve as regards to
Test and performance requirements, as per standard ECE R 110

0.1	Observer: Mr. M.S. Ogale Mr. Yeshwant Ambure	Place : ARAI, Pune and Praj Lab.
0.2	Operator :- Mr. Dekate, ARAI Ashok Bhagat, Praj Lab	Test date:- May'12-June'12
0.3	Customer	BMT CO., LTD 21-1, Bukjeong-dong, Yangsan-si, Gyeongsangnam-do, 626-110 S.Korea
1.0	Component under test	High Pressure Ball Valve SCBV3601-F6N and SCBV3603-S16
2.0	**Manufacturer's Specification**	
2.1	Trademark or Trade name	SUPERLOK T&S VALVES
2.2	Model name and number	High Pressure Ball Valve (SCBV360 Series) (SCBV3601, SCBV3602, SCBV3603)
2.3	Manufacturers Specification	As attached at Enclosure 1
3.0	**Results of Tests**	
	General Requirements of standard	**Observations**
3.1	The manual valve device in Class 0 shall be designed to withstand a pressure of 1.5 times the working pressure.	Meets the Requirement Satisfactory
3.2	The manual valve device in Class 0 shall be designed to operate at a temperature from -40^{o} C to 85^{o} C.	Meets the Requirement Satisfactory
3.3	Manual valve device requirements	
3.3.1	One specimen shall be submitted to a fatigue test at a pressure cycling rate not to exceed 4 cycles per minute as follows: (i) Held at 20 °C while pressured for 2,000 cycles between 2 MPa and 26 MPa.	Meets the Requirement Satisfactory

Manufacturer: BMT CO., LTD

Component type: High Pressure Ball Valve SCBV360 Series.

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<table>
<tr><td>4.0</td><td colspan="4">Specific test requirements</td></tr>
<tr><td>4.1</td><td colspan="4">Overpressure Test:</td></tr>
<tr><td></td><td colspan="3">A CNG containing component shall withstand without any visible evidence of rupture or permanent distortion a hydraulic pressure of 1.5 times the working pressure (MPa) during minimal 3 minutes at room temperature with the outlet of the high-pressure part plugged. Water or any other suitable hydraulic fluid may be used as a test medium.</td><td>Observations:

Water used as test medium.
No leakage observed at 1.5 times working pressure of 390 bar

Meets the Requirement
Satisfactory</td></tr>
<tr><td></td><td>Class</td><td>Working pressure</td><td>Test pressure</td><td></td></tr>
<tr><td></td><td>Class 0</td><td>3000<P<26000</td><td>1.5times working pressure</td><td></td></tr>
<tr><td></td><td colspan="3">1. Working pressure: 260 bar
2. Test Pressure: 390 bar</td><td></td></tr>
</table>

<table>
<tr><td>4.2</td><td>EXTERNAL LEAKAGE TEST</td></tr>
<tr><td></td><td>A component shall be free from leakage through stem or body seals or other joints, and shall not show evidence of porosity in casting when tested as described in the tests below.</td></tr>
<tr><td></td><td>The test shall be performed at the following conditions:
(a) at room temperature at pressure of 390 bar.
(b) at the minimum operating temperature: -40°C at pressure of 390 bar
(c) at the maximum operating temperature: +120°C at pressure of 390 bar</td></tr>
<tr><td></td><td>Equipment under test will be connected to a source of aerostatic pressure. An automatic valve and a pressure gauge having a pressure range of not less than 1.5 times nor more than 2 times the test pressure is to be installed in the pressure supply piping. The sample is subjected to the gas pressure equal to working pressure. The sample should be submerged in water to detect leakage or any other equivalent test method Test carried out under following conditions</td></tr>
<tr><td></td><td>The external leakage must be lower than the requirements stated in the annexes or if no requirements are mentioned the external leakage shall be lower than 15 cm3 /hour.</td></tr>
<tr><td>4.2.1</td><td>Room temperature test</td></tr>
<tr><td></td><td>Requirements:
A CNG containing component shall not leak more than 15 cm3/hour with the outlet plugged when submitted to a gas pressure, at room temperature</td><td>Observation:
No Leakage Observed.

Meets the Requirement
Satisfactory</td></tr>
</table>

4.2.2	**Maximum operating temperature test**	
	Requirements: A CNG containing component shall not leak more than 15 cm3/hour with the outlet plugged when submitted to a gas pressure at the maximum operating temp of 120°C, after conditioning the component for 8 hours at 120°C	**Observations:** No Leakage Observed. Meets the Requirement Satisfactory
4.2.3	**Minimum operating temperature test**	
	Requirements: A CNG containing component shall not leak more than 15 cm3/hour with the outlet plugged when submitted to a gas pressure, at the minimum operating temp of -40°C , after conditioning the component for 8 hours at -40°C	**Observations:** No Leakage Observed. Meets the Requirement Satisfactory

4.3	**Internal Leakage test**	
	The seat of the valves, when in the closed position, shall be free from leakage at any aerostatic pressure between 0 to 1.5 times the working pressure (kPa). The internal leakage tests are conducted with the inlet of the sample valve connected to a source of aerostatic pressure, the valve in the closed position, and with the outlet open. An automatic valve and a pressure gauge having a pressure range of not less than 1.5 times nor more than 2 times the test pressure is to be installed in the pressure supply piping. The pressure gauge is to be installed between the automatic valve and the sample under test. While under the applied test pressure, observations for leakage are to be made with the open outlet submerged in water unless otherwise indicated.	
	Test condition: Test Pressure: 390 bar	**Observation:** No Leakage observed. Meets the Requirement Satisfactory

4.4	**Fatigue Test:**	
	Requirements: Component shall be submitted to a fatigue test at a pressure cycling rate not to exceed 4 cycles per minute as follows: (i) Held at 20 °C while pressured for 2,000 cycles between 2 MPa and 26 MPa.	**Observations:** Meets the Requirement Satisfactory

4.5 CNG Compatibility Test

A synthetic part in contact with CNG shall not show excessive volume change or loss of weight. Resistance to n-pentane according to ISO 1817 with the following conditions:
(a) medium: n-pentane
(b) temperature: 23 °C (tolerance acc. to ISO 1817)
(c) immersion period: 72 hours

Requirements:
maximum change in volume 20 percent After storage in air with a temperature of 40 °C for a period of 48 hours the mass compared to the original value may not decrease more than 5 percent.

Observations:

Sr. No.	Sample Identification Mark	Change in Volume in %		Change in Mass in %		Remark
		Specified Value	Observed Value	Specified Value	Observed Value	
1	PTFE	20 Max.	0.06	- 5 % Max	-0.2	OK
2	PEEK	20 Max	0.07	- 5 % Max	-0.01	OK
3	'O' ring	20 Max	2.5	- 5 % Max	- 3.48	OK

Meets the requirements
Satisfactory

4.6 CORROSION RESISTANCE TEST

A metal CNG containing component shall comply with the leakage tests, after submitting it to 144 hours salt spray test with all connections closed. Solution: 5% NaCl in 95% distilled water by weight. External leakage test carried out at room temp/ at 120°C / at -40°C and internal leakage test carried out at room temperature

Observation: No corrosion observed & No leakage observed.
Meets the Requirement
Satisfactory

External Leakage Test after corrosion test:

Test Conditions:	Room Temp	Low Temp	High Temp
	30° C at 390 bar	-40° C at 390 bar	+120°C at 390 bar
Observations:	**No Leakage Observed**	**No Leakage Observed**	**No Leakage Observed**
	Meets the Requirement Satisfactory		

	Internal Leakage Test after Corrosion:	
	Internal Leak test at room temperature as per Annex 5C	**Observations**: No leakage observed. Meets the requirements Satisfactory.

4.7	**Resistance to dry heat**
	Requirements: 1. The test has to be done in compliance with ISO 188. The test piece has to be exposed to air at a temperature equal to the maximum operating temperature for 168 hours. 2. The allowable change in tensile strength should not exceed 25 per cent. The allowable change in ultimate elongation shall not exceed the following values: -Maximum increase 10 per cent -Maximum decrease 30 per cent

Observations:

Sr. No.	Sample	Change in Tensile strength in %		Change in elongation %		Remark
		Specified Value	Observed Value	Specified Value	Observed Value	
1	PTFE	+25 Max	9.20	+10 -30	-0.64	OK
2	PEEK		2.61		- 27.3	OK
3	O-Ring EPDM		12.37		-17.50	OK

Meets the requirements
Satisfactory

4.8	**Temperature cyclic test**			
	A non metallic part containing CNG shall comply with the leakage tests mentioned in Annexes 5B and 5C after having been submitted to 96 hours temperature cycle from the minimum operating temperature up to the maximum operating temperature with a cycle time of 120 minutes, under maximum working pressure			
4.8.1	**External Leakage Test after temperature cyclic test:**			
	Test Condition	Room Temp	Low Temp	High Temp
		30°C at 390 bar	-40° C at 390 bar	+120°C at 390 bar
	Observations :	**No Leakage Observed**	**No Leakage Observed**	**No Leakage Observed**
		Meets the Requirement Satisfactory		
4.8.2	**Internal Leakage Test after temperature cyclic test:**			
	Internal Leak test at room temperature as per Annex 5C		**Observations**: No leakage observed. Meets the requirements Satisfactory.	

Manufacturer: BMT CO., LTD

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4.9	**Vibration Resistance:**			
	Requirements: All components with moving parts shall remain undamaged, continue to operate, and comply with the component's leakage tests after 6 hours of vibration in accordance with the following test method. **Test method** The component shall be secured in an apparatus and vibrated for 2 hours at 17 Hz with an amplitude of 1.5 mm (0,06 in.) in each of three orientation axes. On completion of 6 hours of vibration the component shall comply with Annex 5C.		**Observations:** No Leakage observed. Meets the requirements. Satisfactory.	
4.9.1	**External Leakage Test:**			
	Test Condition	Room Temp	Low Temp	High Temp
		30°C at 390 bar	-40° C at 390 bar	+120°C at 390 bar
	Observations :	**No Leakage Observed**	**No Leakage Observed**	**No Leakage Observed**
		Meets the Requirement Satisfactory		
4.9.2	**Internal Leakage Test:**			
	Internal Leak test at room temperature as per Annex 5C		**Observations**: No leakage observed. Meets the requirements Satisfactory.	

4.10	**OZONE TEST**		
	Medium : Ozone	Duration: 72 Hours	Ref Standard: ISO 1431-1
	Test Temp: 40°C		
	Requirement of Standard		
	The test piece, which has to be stressed to 20 per cent elongation, shall be exposed to air at 40C with an ozone concentration of 50 parts per hundred million during 72 hours. No cracking of the test piece is allowed.		**Observation:** **No cracks observed at 10X Magnification.** **Satisfactory.**

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4.11 **The operating temperatures of the Manual Valve shall be classified as per the table given below**

ANNEX 5O - OPERATING TEMPERATURES

	Engine compartment	Assembled on the engine	On board
Moderate	- 20 ° C ÷ 105 ° C	- 20 ° C ÷ 120 ° C	- 20 ° C ÷ 85 ° C
Cold	- 40 ° C ÷ 105 ° C	- 40 ° C ÷ 120 ° C	- 40 ° C ÷ 85 ° C

Requirement:	**Observation:**
The Manual Valve should meet operating temperature require as given in the table annex 5O	The High Pressure Manual Valve Type: SCBV3601-F6N and SCBV3603-S16 has the temperature range of -40°C to +120°C. The manual valve meets the test requirements when subjected to all relevant tests with this temperature.

5.0 **Conclusion: High Pressure Ball valve SCBV360 Series described in the information document as above meets the requirement of Regulation ECE R110.**

Yeshwant Ambure
Project Leader

M. S. Ogale
Head Homologation

IFM TÜV NORD Mobilität Designated Technical Service RDW No. 99050016